www.geosyntec.com

Implementation of a Strategic Approach for Complex Vapor Intrusion Assessment at a Large Military Facility

David W. Himmelheber

Emily H. Majcher, Paul Nicholson, Aron Krasnopoler, Todd McAlary, Robert Ettinger (Geosyntec Consultants)

Jennifer Harris (General Physics Corporation)

John Wrobel (US Army, USAG Aberdeen Proving Ground)

Geosyntec consultants

engineers | scientists | innovators

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 2010		**00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Implementation of a Strategic Approach for Complex Vapor Intrusion Assessment at a Large Military Facility	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Geosyntec Consultants,2002 Summit Blvd, NE Suite 885,Atlanta,GA,30319**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 14-17 June 2010 in Denver, CO.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**21**	

Introduction to Vapor Intrusion

What is Vapor Intrusion?

- Vapor intrusion (VI) is the transport of gas-phase contaminants from the subsurface to indoor air
- Typically originates from groundwater and/or soil contamination --- volatile organic compounds (VOCs)
- Exposures of contaminants to building occupants are a major concern
- Relatively new regulatory emphasis on assessing VI risk

ITRC Vapor Intrusion Team logo; http://www.itrcweb.org/teampublic_Vapor.asp

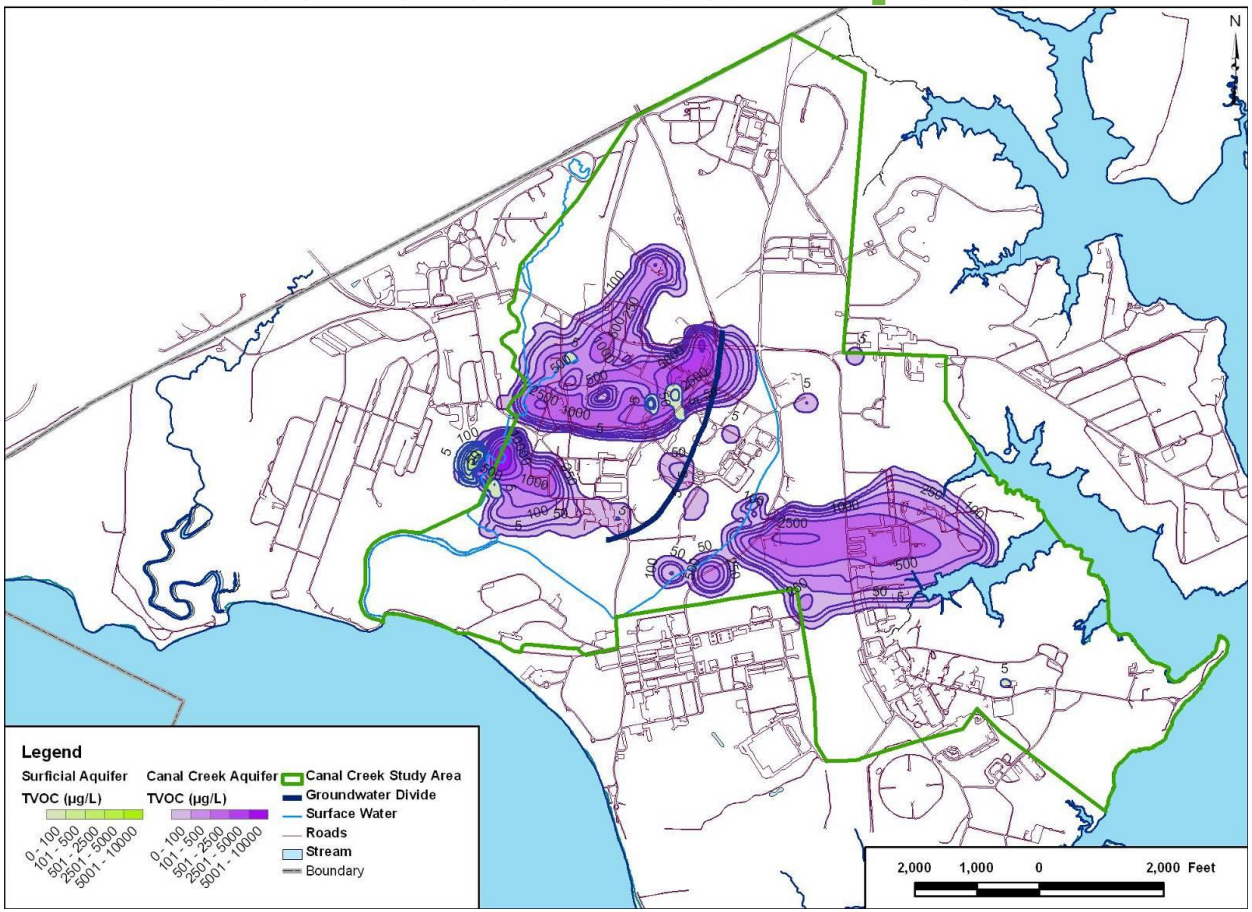
Site Background

Aberdeen Proving Ground (APG)

- Established in 1917 in northwestern region of Chesapeake Bay
- R&D, manufacture of military chemical agents
- Portion of APG placed on NPL site in 1990
- Canal Creek Study Area (CCSA)
  - 700-acre parcel
  - Chemical manufacturing 1918 – end of WWII
  - Current use is lab and pilot scale facilities
  - Over 20 years of soil and groundwater investigations

Site Background

CCSA Groundwater Impacts



(Courtesy of WESTON Solutions)

Site Background

Key Project Challenges

- Large number of buildings on Site (317)
- Unique contaminants uncommon for VI assessments
- Co-mingled contaminant plumes
- Complex hydrogeology below large site
- Working constructively to meet needs of US Army Federal, and State regulators

Proposed VI Assessment Strategies

- Regulatory Agencies
  - Collect indoor air samples from all buildings
- Geosyntec
  - Proposed phased approach for VI evaluation
    - Conceptual Site Model (CSM) development
    - Data collection to refine CSM
    - Follow-up indoor air sampling for sub-set of buildings
    - Evaluate mitigation needs and options

COPC Identification

- Develop list of COPCs based on:
  - Calculated screening levels based on risk to building occupants (no VI screening levels available)
  - Detection frequency analysis
  - Generic VI attenuation factors
- COPC screening results
  - 15 of 90 contaminants retained for groundwater
  - 46 of 160 contaminants retained for soil
  - COPCs include VOCs, SVOCs, PCBs, chemical warfare material (CWM) degradation products, and mercury

Conceptual Site Model Development

- Sources of Contamination
  - Primary – Locations of Former Activities
  - Secondary – Subsurface Contaminant Distribution
- Pathways
  - Geology
  - Hydrogeology
- Receptors (Building) Characteristics
  - Buildings (Use, Occupancy, Foundation, HVAC)

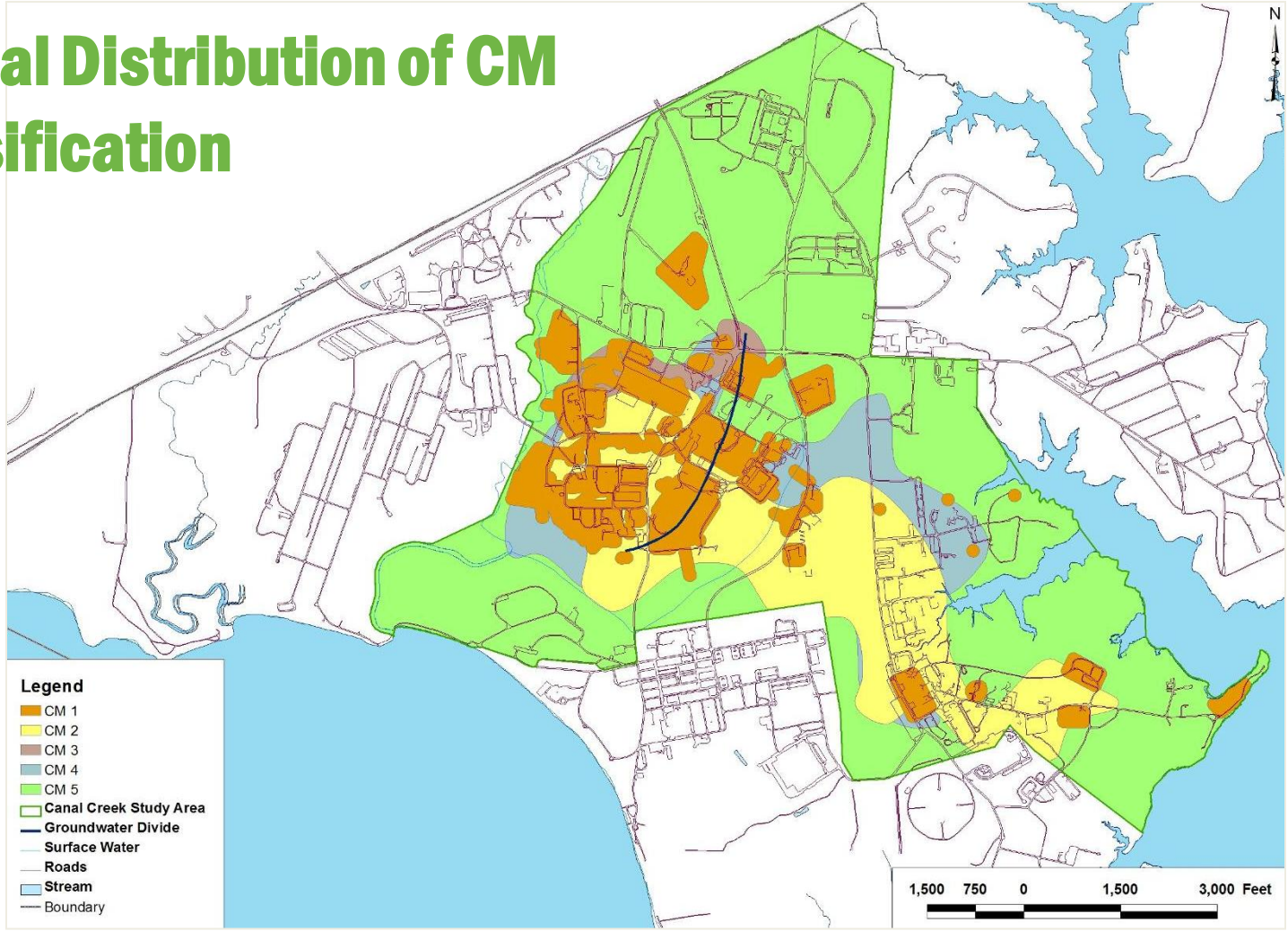
Geosyntec consultants

Conceptual Site Model Development

Conceptual Model ID	Description
Conceptual Model #1 Primary Source Areas	Residual COPCs in the Vadose Zone near or beneath buildings
Conceptual Model #2 Surficial Aquifer Source Areas	COPCs present in unconfined aquifer with no confining unit above the water table
Conceptual Model #3 Upper Confining Unit (UCU) Source Areas	COPCs present in the UCU, and materials above the UCU are unsaturated
Conceptual Model #4 Confined Canal Creek Aquifer (CCA) Source Areas	COPCs are present in the CCA, and the UCU is present above the CCA
Conceptual Model #5 Areas with No Identified Source or No Existing Buildings	No sources or receptors identified

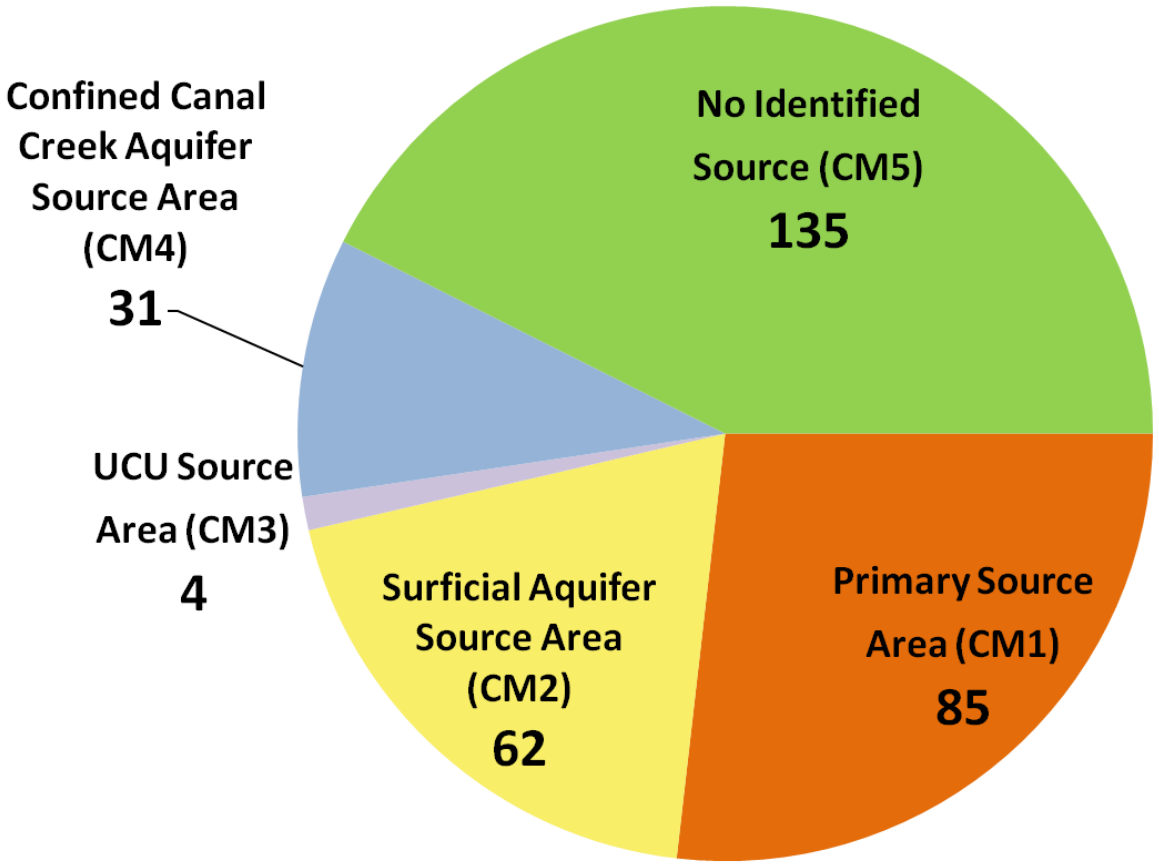
Conceptual Site Model Development

Spatial Distribution of CM Classification



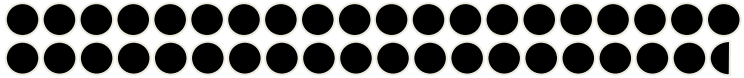
Conceptual Site Model Development

Buildings per CM Classification

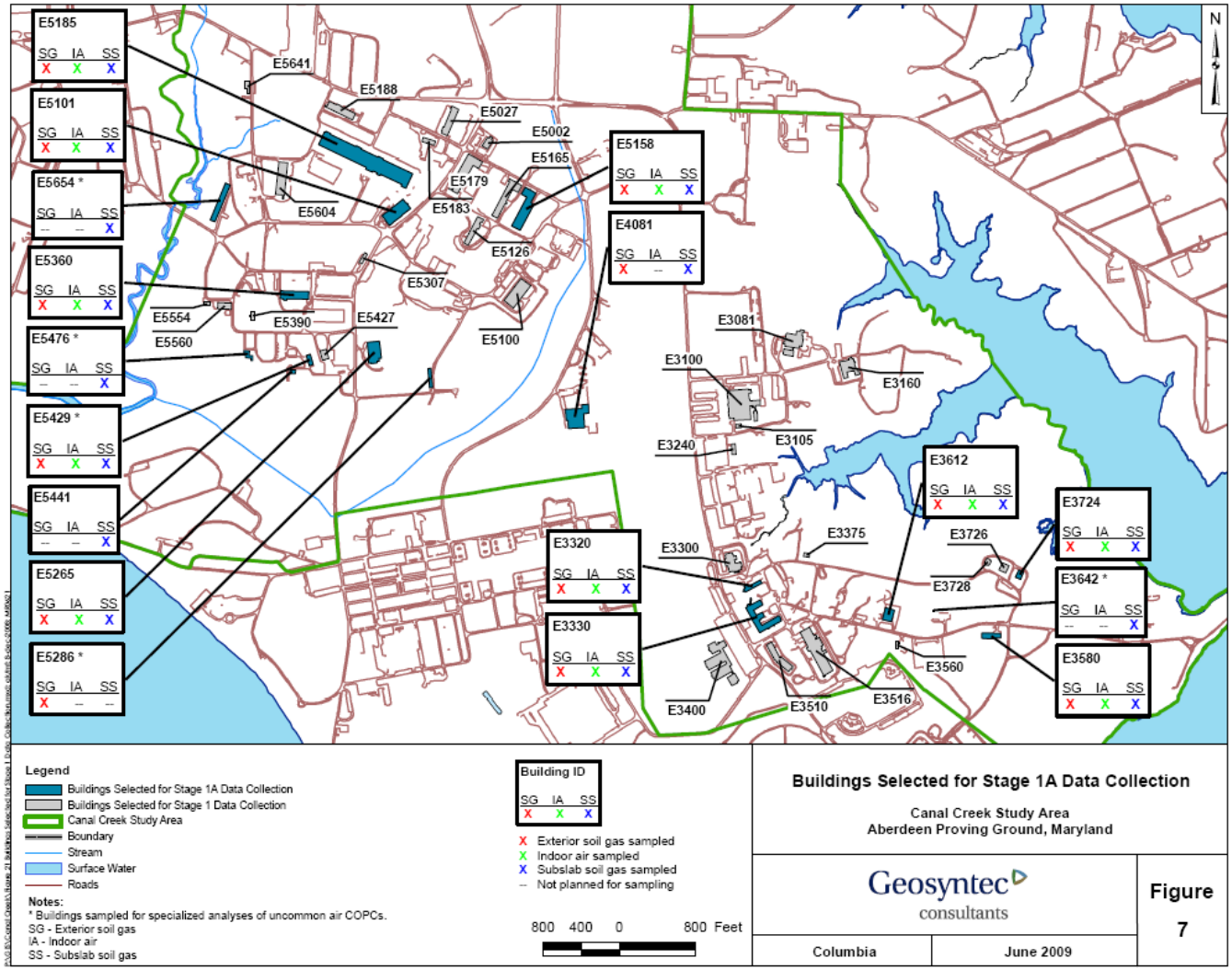


CM 1	27%
CM 2	20%
CM 3	1%
CM 4	10%
CM 5	43%

Conceptual Site Model Development

Evaluation Step	Building Count	
Database/GIS Analysis and Risk Screening	317	
CSM Development	CM1	85
	CM2	62
	CM3	4
	CM4	31
	CM5	131
Building Occupancy Screening	CM1	62
	CM2	29
	CM3	4
	CM4	12
	CM5	104
Stage I Field Investigation	CM1	26
	CM2	9
	CM3	1
	CM4	3
	CM5	2

Conceptual Site Model Development



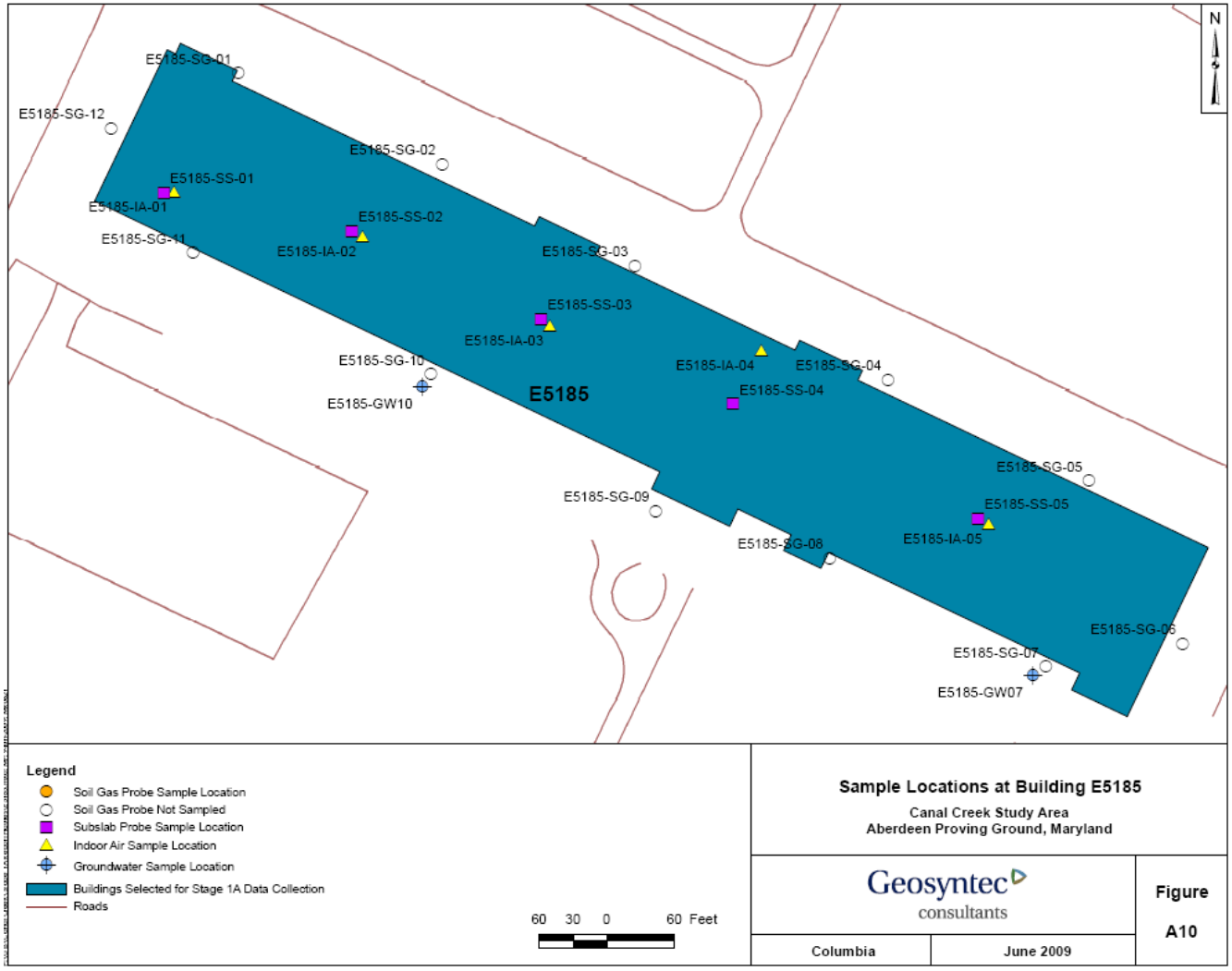
Field Investigation

- Building-specific sampling plans were developed
- Assessment of uncommon and analytically-challenging COPCs at locations of maximum historical concentration
- Groundwater, soil gas, and sub-slab samples around target buildings to assess subsurface vapor sources
- Indoor Air sampling to assess receptor air quality
- Extensive Quality Assurance/Quality Control procedures
  - Pneumatic testing
  - Tracer testing
  - Building ventilation survey
  - Inter-method comparisons
  - Equipment blanks
  - Trip blanks

Field Investigation

- MEC clearance and monitoring during subsurface activities
- High Purge Volume sub-slab sampling to increase spatial footprint of sample
- Sorbent tubes for mercury, pesticides, PCBs, SVOCs, and chemical warfare agents
- Waterloo Membrane Samplers for long-term average indoor air concentrations; selected verification via 8-hr Summa canisters

Field Investigation



Field Investigation

Field Investigation – Results

- Only 2 of 15 buildings in the initial phase of investigation showed potential for VI possessing a complete VI pathway
  - Contaminants detected in subsurface and in indoor air above screening levels
  - Carbon tetrachloride, chloroform, PCE,TCE, hexachloroethane (HCA)
  - Confirmatory sampling during “heating season” verified results
  - Long-term monitoring suggested with mitigative actions possible
- Uncommon COPCs, mercury, pesticides, and most SVOCs were not found to pose unacceptable exposures

Field Investigation – Results

- Quality Assurance and Quality Control procedures well received well by all stakeholders
  - Important when relying on the data for scoping decisions

- Results to date support limiting additional investigations – significant cost savings to the Army

Summary

- US Army was tasked with assessing Vapor Intrusion at a Site with greater than 300 buildings and significant groundwater/soil impacts
- The large number of buildings and unique contaminants created a challenging scenario and led to regulatory stalemate
- Geosyntec was able develop and implement a systematic CSM to prioritize buildings and identify receptors most at risk to potential VI
- Initial field investigations indicate only 2 of 15 high priority buildings have potential VI concerns
- Results to date support limiting additional investigations – significant cost savings to the Army

Thank You for Your Attention!
Questions?

Geosyntec consultants

engineers | scientists | innovators